

Amendments to the Specification:

Please replace paragraph [0071] with new paragraph [0071], shown below

[0057] The flexible link 190, in general, functions as a leaf spring. When the carriage 160 travels away from the wafer 12, for example, the carriage 160 pulls the center 191 of the flexible link 190 away from the wafer 12 and rotates the gripper arms 200 into the wafer-engaging position (Fig. 4). The flexible link 190 compensates for any amount of wafer offset so that, for example, both gripper arms 200 and ~~202~~ engage the wafer 12 even if the wafer is not centered on the wafer blade 111. The flexible link 190 also prevents overloading of the drive mechanism 144 if an operator manually inserts a wafer of the wafer blade 111.

Please replace paragraph [0051] with new paragraph [0051], shown below

[0051] The motor assembly 144, through the cam 150, drives the carriage ~~160~~ 150. Any motion by the cam 150 preferably imparts motion to the carriage 160. The end of cam travel (e.g., cam 150 is located at 0° or 180° degrees), however, may allow a couple degrees of cam motion to translate into no linear motion of the carriage 160. The cam 150, in other words, is not doing useful work during some portion. If the cam 150 is allowed to rotate completely to the 0° or 180° position (defined as an “overtravel” position), the cam 150 further may jam or the end effector 100 will lose track of the precise location of the carriage 160.

Please replace paragraph [0064] with new paragraph [0064], shown below

[0001] The force sensing device 228 provides real-time data to the motor assembly 144 so that the end effector can determine immediately if there is a malfunction. If, for example, the gripper arms 200 attempt to grip the wafer 12 and a wafer 12 is not present on the wafer blade 111, or the wafer 12 slips on the wafer blade 111, the position of motor 146 (as determined by the Hall-effect sensors) will indicate that the gripper arms 200 missed the wafer 12 and moved too ~~to~~ far. If, on the other hand, the wafer 12 pops off the support pads 126, the amount of force measured by the force sensing device 228 will drop immediately and indicate to the end effector that a malfunction has occurred. The thru-beam sensors 222 and 224, in addition the force sensing device 228, also detects the edge of a wafer 12. In general, the force sensing device 228 and the optical sensors provide a double check system to detect a wafer 12 on the wafer blade 111.

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) An end effector adapted to grip a peripheral edge of a workpiece, comprising:

a workpiece blade for supporting a workpiece;

a first gripper arm and a second gripper arm each operatively mounted to said workpiece blade, said first and second gripper arms each including a contact pad;

means for moving said first and second gripper arms between a workpiece-loading position and a workpiece-engaging position, ~~where~~ said contact pads contacting ~~contact~~ the peripheral edge of the workpiece and exerting ~~exert~~ a force on the workpiece when said first and second gripper arms are located in said workpiece-engaging position; and

means for dynamically adjusting the force exerted by the first and second gripper arms on the workpiece after ~~while~~ said first and second gripper arms are located in said workpiece-engaging position.

2. (Cancel)

3. (Original) The end effector according to claim 1, wherein said first and second gripper arms further include a force sensing device adapted to measure the force said contact pads exert on the workpiece.

4. (Original) The end effector according to claim 1, wherein said contact pads further include sensors adapted to detect the edge of the workpiece.

5. (Original) The end effector according to claim 4, wherein said sensors comprise thru-beam sensors.

6. (Original) The end effector according to claim 1, wherein said means for moving said first and second gripper arms comprises a motor assembly that is operatively coupled with said first and second gripper arms.

7. (Original) The end effector according to claim 6, wherein said motor assembly includes:
a brushless motor having an output shaft;

a planetary gear having a first end coupled to said output shaft and a second end having a shaft extending outward from said planetary gear that rotates slower than said output shaft;

a cam coupled to said shaft, said cam having a geometrical center that is offset from the rotational center of said shaft;

a carriage having a drive slot adapted to receive said cam; and

a flexible link having a central portion adapted to secure to said carriage, a first end adapted to secure to said first gripper arm, and a second end adapted to secure to said second gripper arm.

8. (Original) The end effector according to claim 7, further comprising a real-time force feedback system, including:

a force sensing device secured to each one of said contact pads, each force sensing device adapted to generate an electrical signal representing the amount of force being exerted against the workpiece; and

a processor adapted to receive said electrical signal from each said force sensing device and sending an electrical signal to said brushless motor in order to adjust the position of said first and second gripper arms.

9-16. (Withdrawn)

17. (Currently Amended) An apparatus for handling wafers, comprising:

a wafer blade for supporting a wafer;

a first contact arm and a second contact arm each operatively mounted to said wafer blade, said first and second contact arms each having a contact pad adapted to contact a peripheral edge of the wafer;

a motor assembly operatively connected to said first and second contact arms, said motor assembly for moving said first and second contact arms between a wafer-loading position that allows a wafer to be loaded onto said wafer blade and a wafer-engaging position where each said contact pad contacts the peripheral edge of the wafer and exerts a force on the wafer;

a force sensing device for measuring ~~adapted to measure~~ the amount of force each said contact pad exerts against the peripheral edge of the wafer; and

a force feedback system electrically coupled to ~~each~~ said force sensing device and said motor assembly, said force feedback system ~~adapted to control~~ controlling the operation of said motor assembly based at least in part on the amount of force measured by said force sensing device.

18. (Original) The apparatus according to claim 17, wherein said force sensing device measures the force said contact pads exert on the wafer in real-time.

19. (Currently Amended) The apparatus according to claim 17, wherein each said contact pad further includes sensors adapted to detect the edge of the wafer ~~before said contact pad contacts the peripheral edge of the wafer.~~

20. (Original) The apparatus according to claim 17, wherein said force sensing device comprises a load cell.

21. (Original) The apparatus according to claim 17, wherein said force sensing device comprises a strain gauge.

22-23. (Withdrawn)

24-26. (Cancel)

27. (Withdrawn)

28-32. (Cancel)

33-35. (Withdrawn)